Drone Revolution and Modern Warfare

Mains: *GS II – International issues*

Why in News?

Recent conflicts in Ukraine, Lebanon, and West Asia have demonstrated that drones are no longer auxiliary tools but central instruments of warfare.

How wars evolved from Conventional Warfare to Drone-Centric Warfare?

- **Conventional warfare** – For decades, military strength was measured by the possession of advanced fighter aircraft, tanks, artillery systems, naval fleets, and precision-guided missiles.
- Countries with larger defence budgets enjoyed overwhelming battlefield advantages, while weaker states and non-state actors relied on asymmetric warfare tactics such as guerrilla attacks and ambushes.
- **Recent developments** – Recent conflicts have exposed the limitations of this paradigm.
- Cheap, commercially available drones can now perform functions that previously required expensive military platforms.
- They have democratized access to advanced combat capabilities, enabling smaller militaries and even non-state actors to challenge technologically superior adversaries.
- As a result, military power is increasingly determined not only by sophisticated weapons but also by the ability to produce, deploy, and counter large numbers of drones.
- **The World's First Industrial-Scale Drone War –** The Russia–Ukraine conflict represents the most significant example of drone-driven warfare.
- What began in 2022 as a conventional war dominated by tanks, artillery, and aircraft rapidly evolved into an industrial-scale drone conflict.
- Ukraine initially adapted commercially available drones used for photography, mapping, and surveillance.
- These systems were modified for battlefield reconnaissance, artillery spotting, and intelligence gathering.
- Over time, they were weaponized into precision strike platforms capable of attacking enemy personnel, vehicles, and infrastructure.
- By 2024, drones had become integrated into every level of Ukrainian military operations like Tactical battlefield surveillance, Artillery fire correction, Precision strikes against armoured vehicles, Deep attacks on logistics hubs and supply lines and Monitoring enemy troop movements.
- The conflict demonstrated how drones can create a battlespace characterized by

persistent surveillance and rapid engagement, where concealment becomes increasingly difficult.

- **The FPV Drone Revolution –** One of the most transformative developments in Ukraine has been the widespread use of First-Person View (FPV) drones.
- Originally designed for recreational racing, these drones are operated through live video feeds transmitted to virtual-reality-style goggles.
- FPV drones offer several advantages like High manoeuvrability, Precision targeting, Low production costs, and Ease of modification.
- Many FPV drones have been converted into "kamikaze drones" carrying explosive payloads.
- They function as low-cost precision-guided missiles, capable of destroying tanks and military equipment worth millions of dollars.
- This has fundamentally altered battlefield economics. A drone costing a few hundred dollars can neutralize assets that require years of investment and maintenance.
- Consequently, military planners are reassessing the viability of expensive traditional platforms in environments saturated with drones.

What are the technological innovations in drone warfare?

- **Loitering Munitions –** Loitering munitions combine surveillance and strike capabilities.
- These systems can remain airborne while searching for targets before attacking them.
- Such drones provide flexibility and precision against high-value targets, including air defence systems and logistics infrastructure.
- **Bomber Drones –** Commercial quadcopters have been modified to carry and drop grenades, anti-tank mines, and improvised explosive devices.
- Unlike kamikaze drones, bomber drones can return after completing missions and conduct multiple sorties, making them highly cost-effective.
- **Long-Range Strike Drones –** Ukraine has increasingly employed long-range one-way attack drones to target military facilities, supply depots, and critical infrastructure deep inside Russian territory.
- These operations demonstrate the growing strategic role of drones beyond the immediate battlefield.
- **Fibre-Optic Drones –** One of the most significant recent innovations is the emergence of fibre-optic FPV drones.
- Unlike conventional drones that rely on radio-frequency communication, these systems use ultra-thin fibre-optic cables for command and video transmission.
- Advantages include:
    - Resistance to electronic jamming
    - Enhanced reliability in contested environments
    - Improved operational effectiveness under electronic warfare conditions
    - This development highlights the ongoing technological competition between drone operators and counter-drone systems.

How drone warfare in west asia evolved?

- **Hezbollah's Drone Capabilities –** Hezbollah has developed a substantial drone

capability based largely on Iranian technology. Systems such as the Ababil, Mohajer, and Shahed series perform both reconnaissance and strike missions.
- These drones enable Intelligence gathering, Target acquisition, Precision attacks and Long-range strikes.
- Recent reports also indicate the adoption of fibre-optic drones to overcome electronic warfare measures deployed by Israel.
- **Israel's Counter-Drone Strategy –** Israel has responded by developing a sophisticated layered defence architecture against drones.
- Its approach includes, Electronic warfare systems, Specialized radar networks, Artificial Intelligence-enabled detection platforms and Kinetic interception systems.
- Innovative solutions such as drone-on-drone interception seek to neutralize hostile UAVs without relying on expensive missile systems.
- This reflects the growing importance of cost-effective counter-drone technologies.
- **Iran's Drone-Centric Strategy –** Unlike Ukraine or Hezbollah, Iran employs drones as instruments of strategic deterrence and regional power projection.
- Through indigenous systems and support to allied groups across West Asia, Iran has demonstrated the ability to threaten military bases, critical infrastructure, and maritime assets at relatively low cost.
- This strategy highlights how drones can serve broader geopolitical objectives beyond conventional battlefield operations.

What are the implications for modern military doctrine?

- **Persistent Surveillance –** Drones have created a battlefield where movements are constantly monitored.
- The distinction between frontline and rear areas is becoming increasingly blurred.
- **Reduced Value of Conventional Platforms –** Armoured vehicles, artillery positions, and even warships are becoming more vulnerable to inexpensive drone attacks.
- This raises questions regarding the cost-effectiveness of traditional military investments.
- **Importance of Electronic Warfare –** Control of the electromagnetic spectrum has become as important as control of land, sea, or air.
- Electronic warfare capabilities are now essential for both offensive and defensive operations.
- **Industrial Capacity as a Strategic Asset –** Success increasingly depends on the ability to mass-produce drones, replace losses rapidly, and continuously innovate.
- Industrial resilience is emerging as a critical determinant of military effectiveness.

What are the challenges and concerns?

- Despite their advantages, drones also present significant challenges:
    - Escalation of conflicts through low-cost strikes
    - Difficulty in regulating proliferation
    - Increased vulnerability of civilian infrastructure
    - Ethical concerns regarding autonomous targeting systems
    - Growing threats from non-state actors acquiring advanced drone capabilities
    - These concerns underscore the need for international norms and regulations

governing drone warfare.

What lies ahead?

- The drone revolution marks a fundamental transformation in the character of warfare.
- Recent conflicts have demonstrated that military effectiveness is no longer determined solely by expensive platforms and large defence budgets.
- Instead, success increasingly depends on technological innovation, industrial capacity, adaptability, and the ability to integrate drones into military operations.
- As drones become cheaper, more capable, and more widely available, they are reshaping military doctrines, battlefield dynamics, and global security architectures.
- In the emerging battlespace of the 21st century, drones are not merely weapons; they have become the essential infrastructure of modern warfare, influencing how conflicts are monitored, fought, sustained, and ultimately decided.

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Reference

The Hindu| Drone Warfare

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